DEMONSTRATION PROJECT LVM BIOCELLS
LIFE08 ENV/B/000046
INNOVATIVE USE OF 'HYDROGEOBIOCELLS' FOR THE IN SITU TREATMENT OF CONTAMINATED GROUNDWATER

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Introduction

This LIFE+ project focuses on a cost-efficient, energy efficient and environmental advantageous innovative remediation technology.
It can be the solution for:
(1) in situ remediation systems requiring an increase in groundwater flow for the success of the technique and
(2) large CAH contaminations that are difficult and very expensive to remediate with traditional remediation techniques.

Background

European soils contain many legacies from a less sustainable industrial past. Soils, sediments and groundwater are sinks for many contaminating substances and can only improve in a reasonable time if an active clean-up operation is performed. Active clean-ups are very expensive, especially if the area that needs to be decontaminated is large and the contamination is complex and persistent.
Major pollutants present are heavy metals, petroleum hydrocarbons and chlorinated aliphatic hydrocarbons (CAHs). Amongst these, CAHs are the most difficult and expensive group to remediate because of their physical and chemical characteristics. Since they are heavier than water they can easily migrate to large depths. Because they are very soluble in water and slowly degraded, they also form large groundwater plumes that are very difficult to remediate. Because of this, traditional remediation techniques are often inadequate, time-consuming and expensive.

HYDROGEOBIOCELLS (HGBcells) creating an underground reactor

In order to be successful, in situ remediation techniques always require sufficient groundwater velocities. If groundwater flow velocities are too low, one needs to increase them in order to carry out in situ bioremediation. The Cell of Groundwater Modeling of the University of Ghent has developed a technique of hydrogeobiocells (HGBcells), which increases the groundwater flow velocity by a specific pumping and injection scheme in order to create an active zone of dechlorination in the soil.

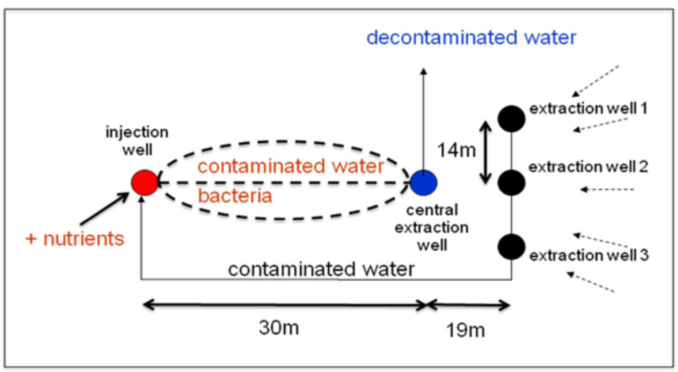

Figure 1 Horizontal section HCB cell

MULTIDECHLOROBAC, the CAH-degrading bacterial team

Anaerobic dechlorination by soil organisms is a promising remediation approach for CAH contamination. The University of Ghent has carried out research which resulted in the isolation of *'Desulfitobacterium dichloroelimans* strain DCA-1'. This bacterial strain is unique and can biodegrade 1,2-dichloroethane (12DCA) to ethene without the formation of toxic intermediate products. Based on this bacterium, Avecom developed a robust multispecies dechlorinating culture that degrades 12DCA as well as chlorinated ethenes (perchloroethene, trichloroethene, …) into ethene. This gives innovative perspectives for the combined removal of the recalcitrant 12DCA and chlorinated ethenes, both present in the groundwater of LVM. One of the goals of this project is to upgrade an innovative production method for the multispecies dechlorinating culture of Avecom. More specifically, an onsite bioreactor is aimed in which the culture can be grown on the contaminated groundwater.

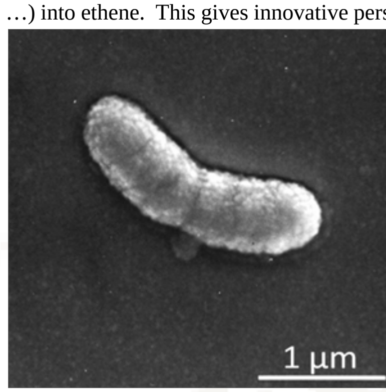

Figure 2 ***Desulfitobacterium dechloroemiliminans*** **stam DCA1**

Objectives

This project aims to demonstrate the applicability of an innovative, cost-efficient and energy-efficient remediation technique for groundwater contaminated with CAHs for a site characterized by low natural groundwater flow velocities.
The main objectives of the project are:

1. Demonstrate the applicability of HGBcells using biostimulation (addition of carbon source) and bioaugmentation (addition of carbon source and bacteria) for the remediation of a CAH groundwater contamination in areas where groundwater velocity is very low due to low hydraulic gradients;
2. Demonstrate the successful up scaling of the production of the dechlorinating microbial culture to be used in the HGBcell for bioaugmentation;
3. Demonstrate the cost efficiency and energy efficiency of the remediation technique (HGBcell using biostimulation and HGBcell using bioaugmentation) for the remediation of CAH contaminated groundwater with an emphasis on 12DCA;
4. Demonstrate the applicability of the groundwater model that was developed;
5. Dissemination of knowledge to stakeholders and the EC.

Furthermore, the practical and economical feasibility of an anaerobic bioreactor for the growth of bacteria on a large scale at the LVM-site, will be investigated. For this bioreactor, the same bacterial population as the one for the HGBcells will be used. This action is an opportunity for further development of the possibilities of bioremediation.

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